Passions for solving problems, enjoying challenges, and pushing myself to overcome any obstacle made it clear that I would become an engineer. When I was seven and going to public school in Spain, I would beg my teacher to give me more math problems instead of attending English class. In 6th grade I signed up to join the Math club in because math was not challenging in class, but my efforts were thwarted when my teacher informed me the club was only for students who needed extra tutoring. I loved competition and enjoyed physical activity, so I threw myself into sports and even though I was undersized, I was always the most determined and yearned to improve. I wanted to “be the ball” as an aspiring soccer player in Spain, spent hours practicing catching outfield fly balls with my dad in middle school, and as a chubby high school freshman I would spend a whole year training with the track and cross-country team to earn my spot on the varsity soccer team the following season. My determination, worldly upbringing, and intrinsic initiative to improve are essential motivations for becoming a researcher.

I first knew that I would dedicate my career towards integrating distributed renewable energy (DER) during a three-day backpacking trip I took with my father in the Rocky Mountains. Nearing the completion of the hike, I climbed up to a vantage point and was completely isolated. I could not believe the beauty and grace of my surroundings but could not shake the dreadful thought that climate change and pollution would destroy this breathtaking landscape in only 20 years. In that moment I decided to devote my career to Power and Energy engineering. This decision would maximize my skills and experience in the ultimate goal of preserving our planet.

Prior to this self-discovering moment, I was planning on a career in hardware and software development because it seemed to be the perfect mix of physical constraints and unlimited possibilities of coding. Pursuing this interest, I worked for the Cooperative Engineering Program at Bridge Fusion Systems LLC (BFS), a tiny electrical engineering consulting company that specialized in custom hardware projects. As only the third employee at the company I was assigned my first project: design code and calibrate a test fixture to load and initialize ARM microcontrollers for installation in wi-fi compatible Smart Plugs. At the end of my first rotation I installed the test fixture and accompanying software at the manufacturing company. I recently learned these smart plugs are being installed in two Pittsburgh buildings potentially saving the city $6.3 million in energy costs over the next 10 years[1]. Learning how to set up, develop, debug, and complete professional projects was an invaluable skill that I applied to school and research projects.

Taking what I learned at BFS to work on sustainable projects, I volunteered my time to a Sustainable Design lab at the University of Pittsburgh. I was the expert in circuitry and embedded programming on the small team of undergraduates building low-cost air quality sensors. The circuits being built for the sensors were difficult to debug and tedious to build, so the project was at a standstill. I was able to quickly identify problems with the circuits but ultimately recommended changing the implementation because of the rigidity of the development software they were forced to use. Another team in this lab was testing the effectiveness of ultraviolet LEDs to decontaminate water. Unfortunately, their circuit design prevented the LEDs from being operable, so I redesigned their code and adjusted the circuitry to simplify their project. Though much of this lab work was rudimentary, it was my first taste of interdisciplinary work and provided the opportunity to apply my skills to benefit sustainable projects.

To widen my breadth of understanding in electrical engineering, take advantage of opportunities available at a research driven university, and use my skills to benefit the environment I contacted Dr. Thomas McDermott to pursue working on one of his projects focused on sustainability. The project I began with Dr. McDermott would last over three summers and was my introduction to the field of Electric Power. The goal was to develop a process to quickly convert Duquesne Light Company’s (DLC), the local electric utility in Pittsburgh, distribution circuit maps into testable models. The need for these models arose because traditional techniques were not sophisticated enough to analyze the impact of distributed photovoltaics (PV) was having on their circuit. To guarantee safety this forced DLC to limit the PV penetration to a measly 15% threshold per circuit. After two summers of designing the process to build circuit models major strides had been made but the project was still incomplete. Determined to apply my models and increase the allowable PV penetration in Pittsburgh I joined DLC as an intern where I enhanced the model building process and designed PV studies. I initially studied DLC’s two highest PV penetrated circuits and was able to conclude that neither circuit had safety concerns, ensuring DLC was in the clear. Since this was the first study of its kind at DLC and my method of building circuit models uniquely did not require any Geographic Information System data, I published a conference paper, with the help of my colleagues, for the 2018 IEEE Power and Energy Society general meeting [2].

My experience with DLC was the primary motivating factor to continue learning about the power industry. The systems and data DLC use to manage their distribution circuits were outdated compared to other industries, but standard for utilities. The models I designed were only band-aids; what DLC really needed was and overhaul to the approach of how problems were solved and a willingness to integrate modern technologies into their system. To get a more general philosophy behind the power industry, a universal methodology for understanding the tradeoff among different approaches in practice, and pioneering a research angle for innovating the game, it was necessary to go to graduate school.

Arizona State University was the obvious choice. The university has 12 faculty members researching power and energy, the largest group in the country, and is the lead university in the Power Systems Engineering Research Center (PSERC), a research collaboration between universities and industry devoted to modernizing the electric grid. As a PhD student at ASU I will be able to leverage the faculty, resources, and research strongly tied to the industry to learn and collaborate with the best. Maybe more importantly, ASU made sense because my grandmother lives in Phoenix. I have been living with her for the past 10 months to fulfill the promise I made in 2015 to move to Phoenix after my graduation. She had been diagnosed with Alzheimer’s a year earlier and was starting to age quickly. At the time committing to moving across the country to help my aunt, a single mother and small business owner, care for my grandmother seemed like a big promise to make but I knew it was the right thing to do. I was able to give my grandmother something to look forward to and I have added stability where my family needed it the most.

Once I arrived in Phoenix, I started pursuing research opportunities at ASU and was blown away by the interdisciplinary research between Machine Learning and Power Systems that Dr. Yang Weng was conducting. Dr. Weng has used machine learning to leverage data to revolutionize utility capabilities with minimal cost leading to five best paper awards in the past six years. Working with Dr. Weng the past half year, I have started to understand the initial philosophy of using data to represent physical systems and how pivotal machine learning is going to be for the future of the power industry. At ASU I will have the opportunity to master the fundamentals of machine learning to motivate control actions necessary to operate DER, connect the applications between the universal methodology among different learning methods, and leverage the unlimited potential of artificial intelligence (AI) to link heterogenous data from diversified domains to revolutionize the power industry and human life. Therefore, I am going to convert to a PhD student in the Spring and dedicate the next 4 years to delve into AI focusing on the fundamental relationships between machine learning, statistics, and the electric grid.

Outside of my studies, I have continued my athletic endeavors and am considered a world class ultimate frisbee athlete. Aside from relieving stress and given me something to work towards, ultimate frisbee has taught me the importance of highlighting individuality in a team setting, provided invaluable leadership opportunities, and given me a space to be creative and process different information. This unique sport awarded me opportunities I never could have imagined, including catching a world championship winning goal for the Under-24 Men’s National team and using my platform to publicly advocate for gender equity [3]. I owe it to the community that gave me so many avenues to success to give back, so I have volunteered to assistant coach the ASU Men’s Ultimate Frisbee team this upcoming season. I plan on continuing as a coach during my stay at ASU and am looking forward to teaching, developing, and being inspired by the upcoming generation of players.

To broaden my volunteering efforts and benefit the family I have begun tutoring my younger cousin with his high school math homework. I am using this opportunity to build our relationship to eventually nudge him to care about more than video games and shoes. This has given me the opportunity to work on a person and being a positive influence on my cousin has been incredibly rewarding. Not only has this ignited my eagerness to help my future students as a teaching assistant, but it has inspired me to pursue STEM outreach opportunities through ASU to mentor the upcoming generation of engineers.

The NSF graduate research fellowship program will give me the resources to continue my mission to modernize the power industry. I will maximize my opportunities at ASU whether or not I am awarded the prestigious honor of NSF fellow, reflecting my history as a coop, undergraduate researcher, intern, and ultimate frisbee player. At ASU I will continue to use my privilege and resources to give back to the systems that allowed me to get me where I am today. I am equipped to wholeheartedly commit to become an expert in AI applied to DER generation and control. I could easily stay in my comfortable job at DLC but being true to myself I am choosing the harder path to contribute to the global effort to create a cleaner more sustainable planet.